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A GIANT NEW SPECIES OF FAIRY SHRIMP OF THE GENUS BRANCHINECTA FROM THE STATE OF WASHINGTON

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In the spring of 1935, I was given two specimens of an exceptionally large and apparently undescribed species of *Branchinecta* by Dr. M. H. Hatch, of the Department of Zoology of the University of Washington. The honor of discovering this giant phyllopod belongs to J. F. Clark, then of Washington State College, who had collected the specimens in the vicinity of Coulee City, Wash., and from whom Dr. Hatch had received them. On May 3, 1936, I visited many of the temporary ponds between Coulee City and the Grand Coulee Dam, in one of which I found the giant *Branchinecta*. Eighty-nine specimens were obtained, of which 39 were males and 50 were females.

The measurements given herein were obtained from 10 mature specimens of each sex, selected to show the range in size of adults. The figures given are averages, with the range following in parentheses.

Genus BRANCHINECTA Verrill

BRANCHINECTA GIGAS, new species

Plates 77–80

Specific diagnosis.—Male: Total length from front to end of cercopods 63 (61–70) mm. Length of combined head and thorax somewhat less than that of combined genital segments and abdomen. Antennule 5.6 (4.2–7.0) mm in length, terminated by a group of about 30 small sensory hairs. Antenna 12.6 (11–15) mm in length,

of two articles. Proximal article cylindrical, slightly constricted near the middle, 7.5 (6.5–9.0) mm in length. Terminal article blunt, somewhat flattened and slightly curved inward, and twisted in such a way that the broader diameter at the tip is at right angles to the corresponding transverse axis at proximal end of the article. Length of terminal article 5.2 (4.5–6.0) mm. Both articles of antenna devoid of processes, tubercles, or denticulations, although both present considerable areas granulous with microscopic papillae. Compound eyes small; peduncles 1.0–1.6 mm long; oval corneal portion 0.60–0.71 mm in the longer (anteroposterior) axis. Median ocellus present. Labrum truncated, bearing a blunt nasiform process. Median border of endopodite bears heavily chitinized hooked spines, with a triangular area of denticles on dorsolateral side. Everted penes bear a spur near the base and two spinose lobes near distal end. Cercopods 13.5 (10.3–16.3) mm in length, diverging, with a row of plumose setae extending most of the length of cercopod on ventrolateral side; similar, but longer, setae occurring dorsally and medially in distal half only.

Female: Total length from front to end of cercopods 86 (69–97) mm. Antennule 5.5 (3.8–6.8) mm in length. Antenna 12.6 (7.8–15) mm in length. Antenna of female composed of one article, tapering gradually to a sharp point. Three-fourths of distance from cephalic end to apex of antenna there is a slight swelling, distally to which antenna presents a feeble sigmoid curve. Ovisac piriform, 11 (7–13) mm in length, 6.2 (4.5–7.5) mm in transverse diameter at base, and carrying 200 to 600 eggs. Females exceed males in all dimensions except for lengths of antennules and antennae and diameter of eye (diameter of cornea slightly smaller than that of male). Average ratio of length of males to that of females is 1:1.36. Cercopods 18.6 (12.5–22.5) mm in length.

Locality.—Temporary alkali ponds in the Upper Grand Coulee, 19 miles north of Coulee City, Grant County, Wash.

Type specimens.—Holotype (U.S.N.M. no. 72572) and paratypes have been deposited in the United States National Museum.

Description.—The color of living specimens was a translucent white, with a mere suggestion of a bluish cast. The intestine in freshly collected specimens was bright red, caused by a diet of red *Diaptomus* sp. The ovaries were pale blue; eggs, when first discharged into the ovisac, pale blue-green, turning yellow before being laid. Cement glands in the ovisac were dark yellow to light brown.

Both articles of the clasping antenna of the male are provided with microscopic papillae, which are likely to be overlooked when the animals are studied with low magnifications. The inner and anterior sides of the terminal half of the distal article are covered with small,

closely set papillae, flat on top, which give the area they cover a tessellated appearance (pl. 80, figs. 5, 6). The papillae are 8μ to 9μ high, 20μ to 30μ in diameter, and are separated by spaces 2μ to 6μ wide. The flat upper surfaces of the papillae have a distinct overhang toward the proximal end of the antenna. In end view the flat surfaces appear to be pitted with minute pores, which, however, are probably spaces beneath the surface of the papillae.

The anterior and lateral sides of the distal fourth of the basal article of the antenna are covered with closely set papillae of hemispherical shape, mostly 7μ to 15μ in diameter and 1μ to 11μ high. Scattered among them are pointed sensory hairs averaging 80μ in length. Toward the proximal end of the basal article these papillae are arranged as scattered and widely separated groups of circular outline, 60μ to 200μ in diameter, with a hair in the center of the group. Toward the periphery of such groups the papillae become lower and broader (pl. 78, fig. 3).

The uniarticulate antennae of the female are tusklike in appearance and exceptionally long. About three-fourths of the distance from the origin of the antenna to its distal end there is a slight swelling, distal to which the antenna tapers more abruptly and presents a feeble sigmoid curve. The terminal portion of the antenna is roughened by low ridges or curved welts, 4μ to 5μ high and 15μ to 45μ in length. In the region of the swelling of the antenna, just proximal to the narrower distal portion, these ridges become transformed into numerous crowded papillae of hemispherical shape, 5μ to 12μ high and 11μ to 18μ wide. These papillae cover the median and anterior sides of the antenna in this region. Interspersed with the papillae are numerous sensory hairs, 30μ to 75μ in length. At the borders of the papillose area the papillae become broader and flatter, often with a depression in the center, and gradually change over into curved ridges. The remaining portion of the antenna, proximal to the swollen papillose area, bears scattering circular aggregations of papillae, similar to those described in the male (pl. 78, fig. 3). The circular areas range from 50μ to 270μ in diameter and contain 7 to 85 papillae. The papillae are arranged in concentric rings about a sensory hair.

The peduncles of the eyes are partly overhung by the anterodorsal part of the head. In the center of the dorsal side of the head, between the eyes, is a sharply circumscribed area, square with rounded corners (pl. 78, figs. 1, 2; pl. 79, fig. 4), the so-called neck organ.

The labrum (pl. 79, fig. 4), which is large and conspicuous, extends from the ventral side of the front to beyond the mouth parts posteriorly and has a notch on each side that fits around the lower end of the mandibles. The posterior end is truncated but bears a

conspicuous median noselike process. The nasiform process and the expanded corners of the labrum are covered with stiff bristlelike hairs grouped in small oblong patches and comblike rows.

The mandible has a large heavy tooth at the posterior angle of the triturating surface. On the dorsal border of this surface the large tooth is followed by a wide gap, then by three or four heavy teeth, which diminish in size. The anterior and ventral borders are bordered by numerous small, needlelike teeth (pl. 77, fig. 4). Rows of small teeth extend inward from the bordering needlelike teeth toward the median line of the triturating surface in its anterior and ventral regions. The outer two or three teeth of each row bear sharp points, the remainder being blunt. The rows often bifurcate as they approach the center, and the teeth diminish in size toward the center (pl. 77, fig. 3).

Between the mandibles and the first maxilla, on each side of the median line, is a pyramidal elevation, roughly 4-sided at the base, about 1 mm in diameter, and covered with fine bristlelike hairs. The nasiform process of the labrum fits in between the apices of these pyramids. The bases of the pyramids block the anterior end of the ventral thoracic food groove, but obviously can be separated to permit the passage of nutriment.

The first maxilla has a strong conical tooth at the anterior corner of its median border, followed by 15 to 20 stout spines. The outer surface of the basal half of the maxillary spines is covered with peculiar flattened spinules, resembling the blade of a dagger, and the terminal half is covered with slender hairs (pl. 79, fig. 5).

The second maxilla is a small papillalike structure about 1 mm long, located near the base of the first phyllopodium. It is covered with groups of short hairs and bears about 10 plumose setae, which project medially.

There are 11 pairs of thoracic appendages (phyllopodia), the first pair of which is slightly smaller than those immediately following. Appendages 2 to 7, inclusive, are about the same size, 7 being perhaps the largest. Appendages 8 to 11 decrease rapidly in size, 11 being about one-half the size of 7. Plate 79, figures 1 and 2, depicts appendages in anterior and median views. The branchial lamina is triangular with serrate borders. The branchial sac (gill) is elliptical in outline. The exopodite is fringed with long plumose setae, shortest near the proximal end and longest (about 1,400μ) at the distal end. Plumose setae of the same general type arise from the external border of the endopodite (pl. 78, fig. 4). These setae are similar to those of the exopodite but are more distinctly jointed at the base. They are shortest at the proximal end of the endopodite and longest near the apex, or inferolateral border, where they reach

a length of 1,500μ. Near the apex of the endopodite the last five or six setae become shorter and stouter, the fine delicate hairlets that border them become shorter and more bristlelike, and the setae transform rather abruptly to the hooked spines of the internal border of the endopodite.

A typical spine of the distal half of the median border of an endopodite is depicted in pl. 79, fig. 3. The tip is turned dorsally to form a hook with an arrowhead tip. On the dorsoposterior side of the spine a triangular area, outlined by a row of denticles about 30μ in length, extends from the hook about three-fourths the length of the spine toward its base. Inside this triangular area there is a dense aggregation of slightly shorter denticles, about 22μ in length, arranged in poorly defined oblique rows.

The number of these hooked spines varies somewhat in different appendages and also from individual to individual. Starting at the distal end of the endopodite of an appendage from the middle of the series there may, or may not, be a heavy, straight-tipped, denticulate spine. Next are six to nine denticulate spines with strongly hooked tips, of the type shown in pl. 79, fig. 3. The proximal 12 or 13 spines become progressively straighter at the tip and slenderer; the denticles become more closely set and delicate, and the area of denticles extends more completely around the spines until the last few (two to five) become slender, straight-tipped setae whose entire surface in the distal two-thirds is covered with fine hairs (pl. 80, fig. 2). In appendage 11 none of the denticulate spines has a strongly hooked tip.

The five endites are bordered by long setae of the type just described (pl. 80, fig. 2). Endites 1 and 2 are swollen and are nearly 1 mm in anteroposterior diameter. They bear a row of stout setae, which arise near the edge on the posterior side; endite 1 bears two setae near the anterior border, accompanied each by a small spur; endite 2 bears one such setae and spur. Endites 3 to 5 are broadly swollen, bearing 5 to 12 setae on the anterior border and 3 to 5 on the posterior border. Endites 3 and 4 bear each a long hairless seta in the center of the median surface.

The anterior and posterior surfaces of the tip and median border of the endopodite and of the border of all the endites are covered with fine, short, bristlelike hairs about 15μ in length, arranged in short comblike rows (pl. 79, figs. 1, 3; pl. 80, fig. 2). These fine bristles, the tips of which are directed medially and dorsally, thus form a broad band on both sides of the median borders of the appendages. The lateral walls of the ventral thoracic groove are also fringed with thickly set stiff hairs about 50μ in length (pl. 79, figs. 1, 2, *t. g.*).

The penes are eversible and retractile. In most of the specimens they are wholly retracted or only partially protruded. Plate 80,

figure 1 is a ventral view of the genital segments of the specimen in which the penes were farthest protruded. The penes in this individual are about 2.2 mm in length. On the inner side, near the proximal end, is a conical spur, 410 μ in length, and on the lateral side, near the distal end, is a rounded eminence, 360 μ in diameter, covered with short conical spines 20 μ in height. At the tip of the everted penis, on its lateral side, is a second eminence, about 200 μ in diameter, of similar appearance and spination.

The testes extend from some part of the third, or the anterior region of the fourth, abdominal segment anteriorly into the first genital segment. Near the junction of the two genital segments a vas deferens leaves each testis and courses ventrally and posteriorly to communicate with the penis. A large ventral outpocketing of the vas deferens near its junction with the penis serves as a seminal vesicle.

The ovaries originate in some part of the fourth or fifth abdominal segment and extend anteriorly into the seventh (rarely only into the eighth) thoracic segment. They are crowded with eggs of irregular or angular shape from mutual pressure. Near the boundary between the two genital segments a conspicuous oviduct passes from each ovary into the ovisac. The ovisac has an elongated piriform shape, thus differing from that of most species of the genus in which it is more or less fusiform. There are paired cement glands overlying the dorsal side of the egg mass for about three-fourths the length of the ovisac and extending laterally and ventrally to the egg mass in the proximal one fourth of the ovisac. By actual count the number of eggs present in the ovisacs of three specimens was 210, 256, and 595, respectively. Apparently mature eggs from preserved specimens are 580μ (570μ–595μ) in diameter.

There are seven abdominal (postgenital) segments. The terminal one is bifurcated and bears the anus, which is a vertical slit at the junction of the two short limbs of the bifurcation. Each cercopod is attached to the ends of the seventh segment by an obscure articulation. The cercopods curve outward, often with a slightly spiral twist (pl. 80, fig. 3).

Remarks.—Branchinecta gigas, by far the largest known species of the genus, is the fourteenth species of *Branchinecta* to be described and the fifth reported from North America. Only *B. ferox* (Milne Edwards) from eastern Europe and Asia Minor, in which the males reach a maximum length of 51 mm, the females of 70 mm, approaches this new species in size. *B. gigas* differs from all known species of the genus in its large size and in having the antennae of the female as long as those of the male. It is the only species known that is wholly without tubercles, processes, or denticulations on the

inner aspect of the basal article of the male antenna (Daday de Deés, 1910, fig. 121, p. 157, figures *B. orientalis* with a roughened tubercle ["tuberculo rotundato, scabroso"] on the basal article of the antenna, which, however, Bond, 1934, p. 34, describes as a "slight setulose or smooth bulge").

Only two species of *Branchinecta* resemble *B. gigas*, namely, *B. ferox* (Milne Edwards) and *B. orientalis* Sars. *B. ferox* differs from *B. gigas* in that the antenna of the male has a large roughened tubercle on the inner aspect of the basal article; the antenna of the female is short, scarcely longer than the antennule, and flattened; the ovisac is elongate-fusiform, and both sexes have a narrow triangular process on the posterior end of the labrum.

B. orientalis Sars differs from *B. gigas* in the following features: The basal article of the antenna of the male is relatively shorter and stouter; the antennae of the female are short, about the length of the antennule, broad, flat, and ending in a short lateral point separated by a notch from the broad part of the antenna; the ovisac is fusiform; in both sexes the posterior end of the labrum bears a vertical lamella, the cercopods are fringed with setae nearly to the base on both sides, and the lamina branchialis is roughly quadrangular in shape.

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EXPLANATION OF PLATES

Plate 77, figures 3 and 4; plate 78, figures 3 and 4; plate 79, figures 3 and 5; and plate 80, figures 2, 5, and 6 were drawn with the aid of a camera lucida. The remaining figures were made without the aid of drawing apparatus but with all proportions conforming to careful measurements of the specimen.

Abbreviations

a.=Area of attachment of first thoracic appendage.
br. l.=Branchial lamina.
br. s.=Branchial sac, or gill.
c. g.=Cement gland.
end.=Endopodite.
ent. 1=Endite 1.
ent. 5=Endite 5.
ex.=Exopodite.
l.=Labrum.
mx. 2=Second maxilla.
na. p.=Nasiform process of labrum.
n. o.="Neck organ."
ov.=Ovary.
t. g.=Lateral border of thoracic groove.

PLATE 77

1. Male specimen. × 2.
2. Female specimen. × 2.
3. Two adjacent rows of teeth from the anteroventral portion of the triturating surface of a mandible, seen from above. Not all the rows are bifurcated, as are those of the illustration. × 460.
4. Triturating surface, left mandible of a female, oblique view. × 240.

PLATE 78

1. Anterodorsal view of head of a male. × 4.
2. Anterodorsal view of head of a female. × 4.
3. Papillae and sensory hair from proximal portion of antenna of a female. Similar papillae and hairs occur on the basal article of the male antenna. × 460.
4. Seta from the ventrolateral border of the endopodite of a thoracic appendage. × 108.

PLATE 79

1. Left fifth thoracic appendage of a female, anterior aspect. × 6.
2. Left seventh thoracic appendange of a male, median aspect. × 6.
3. Hooked denticulate spine from the right seventh thoracic appendage, posterior aspect, showing comblike rows of stiff hairs on the border of the endopodite. × 108.
4. Lateral view of head and first thoracic segment of a female. × 4.
5. Portion of seta from the first maxilla, showing the daggerlike spinules of the basal half and the hairs of the terminal half. × 460.

PLATE 80

1. Ventral aspect of male genital segments, with everted penes. × 10.
2. Plumose seta of the type found on the endites and the proximal portion of the median border of the endopodite, showing the comblike rows of hairs on the border of the endite. × 460.
3. Ventral aspect of the terminal segment of the abdomen, and the cercopods. × 4.
4. Genital segments and ovisac of a female, lateral aspect. × 6.
5. Papillae, from the distal end of the second article of the antenna of a male, in end view. × 460.
6. Papillae, from the distal end of the second article of the antenna of a male, in side view. × 460.

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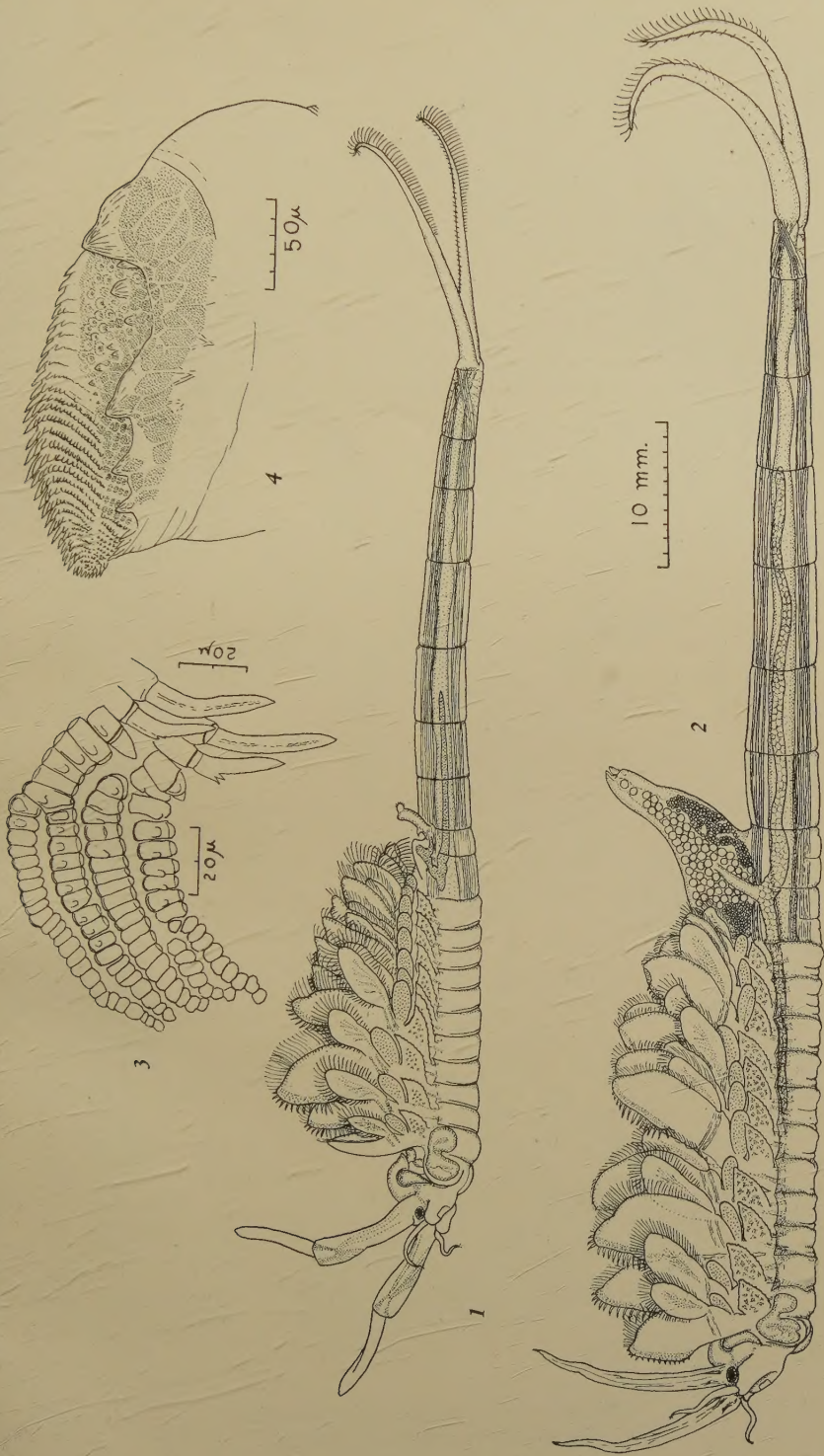
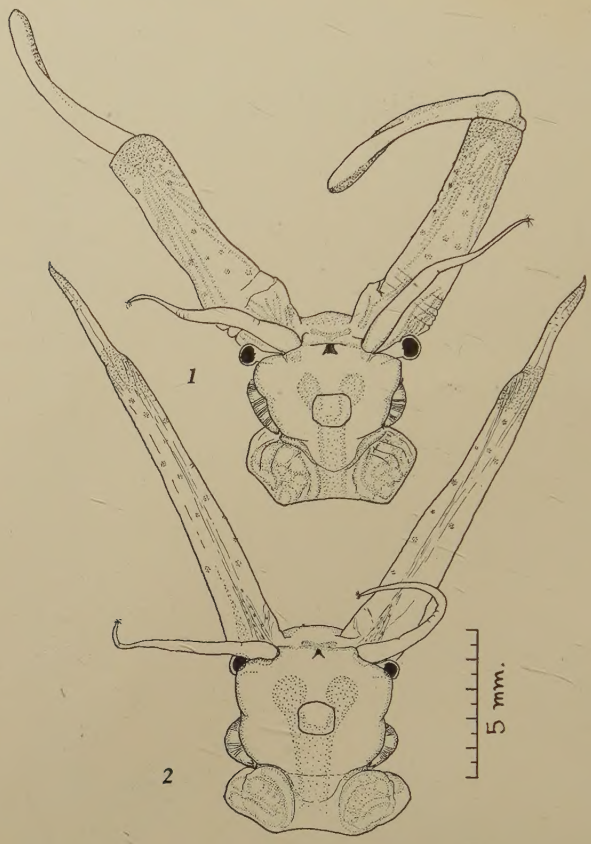
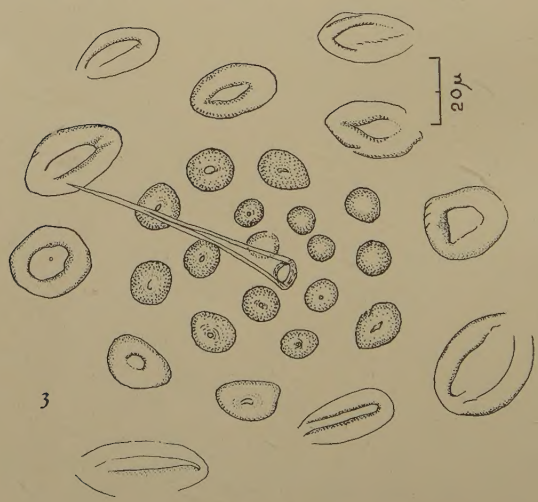
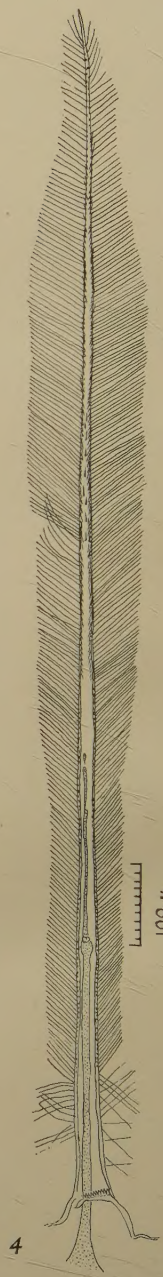


BRANCHINECTA GIGAS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 562.

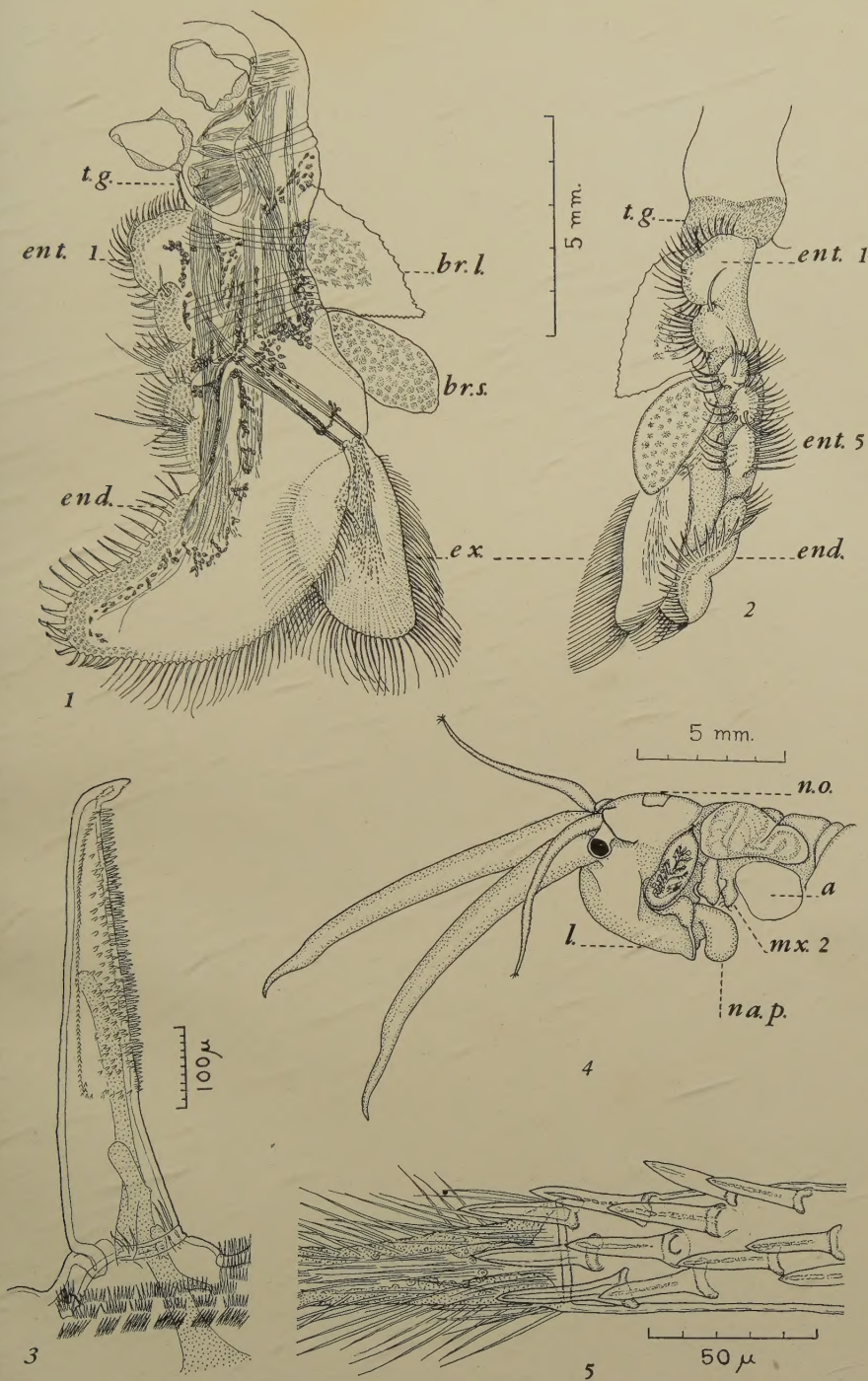






BRANCHINECTA GIGAS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 562.



BRANCHINECTA GIGAS, NEW SPECIES.

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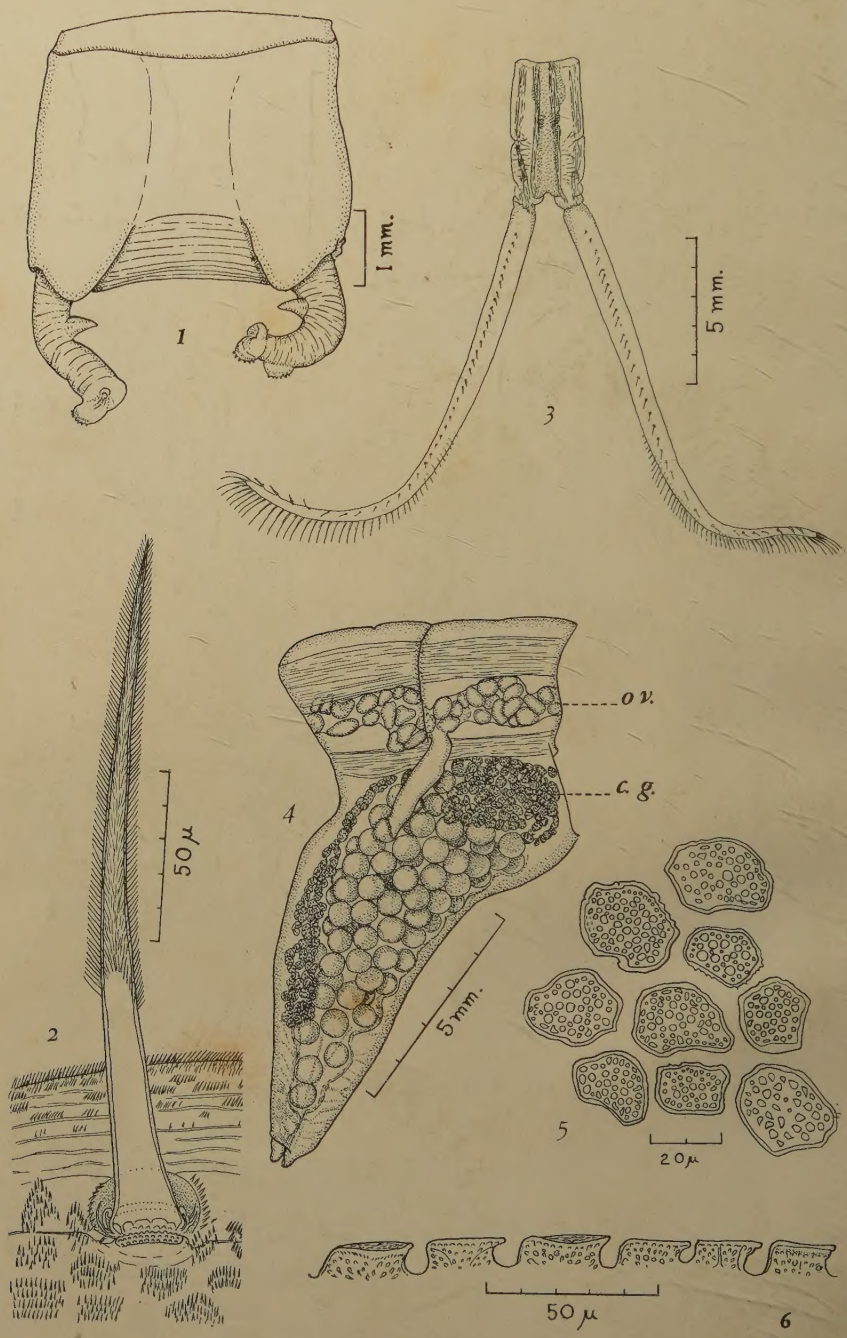

BRANCHINECTA GIGAS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 562.